

# **AEROnet Service Level Agreement**

**between**

## **NASA Integrated Services Network**

**and**

## **Numerical Aerodynamic Simulation Program**

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## **1. Introduction**

### **1.1 Purpose**

This Service Level Agreement (SLA) document defines the services and products to be provided to the Numerical Aerodynamic Simulation (NAS) Program (managed by the Ames Research Center (ARC)) by the NASA Integrated Services Network (NISN) (managed by the Marshall Space Flight Center (MSFC)). The NISN strives to minimize Agency costs for wide area telecommunication services through sharing of resources and eliminating duplications of effort while supporting the various Agency Enterprises' missions via telecommunication and networking services.

### **1.2 Overview**

In September, 1996 a Memorandum of Understanding was signed between Ames Research Center and Marshall Space Flight Center transitioning responsibility for ARC-managed wide area networks to MSFC. These networks, the NASA Science Internet (NSI) and the AEROnet are to become the management responsibility of the NASA Integrated Services Network (NISN). The NISN project itself is an outgrowth of the management consolidation of the NASA Communications (Nascom) and the Program Support Communications Network (PSCN).

The ARC/MSFC MOU specifically states that MSFC is to:

*Assume operational and engineering responsibilities for AEROnet, meeting the programmatic requirements within budgetary and technological constraints."*

ARC is to:

*"Facilitate the transfer of the operations and engineering responsibilities of AEROnet to MSFC; programmatic and requirements responsibility will continue to reside with the NAS Program Manager sited at ARC."*

This document will facilitate the transfer of the AEROnet engineering and operations responsibilities from the NAS program at ARC to the NISN program at MSFC.

### **1.3 Scope**

This agreement covers all engineering, operations, provisioning, of production wide area telecommunication services supporting the NAS Program. This supporting telecommunications system is known as the AEROnet.

## **1.4 Changes**

Changes to this agreement must be by mutual agreement of the NAS and NISN Programs.

## **1.5 Applicable Documents**

This document is in support of the Memorandum of Understanding for Wide Area Network Consolidation approved by the MSFC and ARC, dated September 1996.

## **2. Services**

The NISN shall provide wide area telecommunications services in support of the NAS program. In providing these services, the NISN shall perform the following functions with the specified criteria.

### **2.1 Requirements Planning & Definition**

#### **2.1.1 Process**

The NAS is fully responsible for identifying and funding new requirements/locations for connectivity to the NAS facilities. The NAS shall enter into appropriate agreements with the location requiring connectivity and shall consult with the NISN before committing to providing connectivity for non-standard telecommunication services.

The identification of NAS user requirements will require the active participation of both NAS and NISN, with the NAS having full final decision responsibilities. The NAS shall identify potential locations, NISN shall provide supporting preliminary engineering planning and budget estimates, with NAS making the final determination of sites to be provided service and the attributes of that service. The NAS shall submit a service request to NISN for each new or changed requirement which will include the following information at a minimum:

- Addition or removal
- Site Name
- Site Address
- Site technical POC
- Site principal investigator (PI)
- Security requirements for this site
- Quality of service parameters to include: Sustained Information Rate (SIR) required, Burst Information Rate (BIR) required, and Latency requirements
- Traffic type: Interactive, Real-time, Batch, etc.

The NISN shall support the requirements definition process by providing service pricing estimates upon request. See section 3.5 for the process flow chart.

#### **2.1.2 Requirement Implementation:**

Each requirement submitted by the NAS shall be negotiated on a case-by-case basis as to the expected completion date. Appendix A describes the expected service intervals that NISN shall achieve at least 90% of the time following submission of a funded service request by NAS.

The NAS Technical Point-of-Contact (TPOC) shall be kept informed of any situation where the above time frames can not be met, the reason for the delay, and the new estimated time for completion of the service request.

## ***2.2 Engineering***

### **2.2.1 Design Goals**

As a basic engineering and design principle, the merit of any and all network architecture changes must be measured against the change in the performance characteristics of the network. As a goal, the WAN service must strive to provide a remote user an equivalent service and use of the NASA facility as that offered to local NAS users. Any changes that decrease the performance of the network as experienced by the NAS customers must be accompanied by the trade-off analysis that identifies what is to be gained by making such a change in the network. This NISN study shall be specifically presented to NAS management.

The performance parameters to be considered in sustaining and new engineering include data latency, connection capacity, reliability, and security. These parameters apply to Continental U.S. locations only (CONUS). Any non-CONUS requirements will be addressed on a case-by-case basis.

### **2.2.2 Engineering Performance Parameters**

#### **2.2.2.1 Latency**

The delay requirements for remote NAS users are classified into two categories:

1. General delay requirements
2. Specialized delay requirements for the high-end customers

##### **2.2.2.1.1 General NAS customer requirements**

The round trip delay requirement between any site within CONUS cannot exceed 100ms.

#### 2.2.2.1.2 Specialized NAS customer requirements

For the specialized NAS customer, it will be necessary to provide better delay and jitter characteristics than for general NAS customers. These customers will be identified as special case users at the time the request for NISN service is submitted. In general it is expected that the underlying network system be capable of supporting delay requirements on the order of 60 ms round-trip

#### 2.2.2.2 Capacity

Capacity is defined as the amount of available bandwidth provided to a remote NAS customer. It is required that during the requirements submission for a site, a capacity level be defined by the NAS. Examples of how this capacity could be specified are; Frame Relay Committed Information Rate (CIR) and Burst Information Rates (BIR), SMDS classes of service, ATM CIRs/BIRs, etc.

#### 2.2.2.3 Reliability/Availability/Maximum Time to Restore Service

NISN shall engineer the services provided to NAS to meet the service reliability/availability parameters specified below.

	<b>Availability</b>	<b>Maximum Time to Restore Service</b>	<b>Acceptable Packet Loss</b>
<b>AEROnet Requirements</b>	>0.995	<24hr	<1%

#### Definition of Terms:

**Packet Loss:** Packets transmitted from source NISN/customer interface but not received at destination NISN/customer interface. Acceptable loss is measured over any 24hour interval.

**Maximum Time to Restore Service:** Maximum time to restore is 24 hours and excludes time required to gain access to a customer facility. At some locations, fault isolation and recovery will require the participation of the customer as well. NISN's objective is to have the mean time to restore service < 4 hours (Mean-time-to-restore-service can be misleading since inducing several short failures will improve the mean). The measured time-to-restore is suspended from Friday 7:00pm through Monday 7:00am Pacific Time.

**Availability:** Availability is measured over the period of one year (8760hours). A failure is defined as an event which results in >5% packet loss at NISN's interface to the customer. Service availability excludes scheduled preventative maintenance or upgrades. NISN's approach for measuring availability will include the customers service access point as well as the availability of the shared resources within the network, i.e., the backbone.

**Maximum Round-Trip-Time:** as measured by ping or similar utility.

#### **2.2.2.4 Security**

The security requirements for remote NAS customers is defined in two categories:

##### **2.2.2.4.1 Restricted Access**

- A remote site can only be accessed by specified list of sites/networks/hosts via this connection
- A remote site can only access a specified list of network/hosts via this connection.

A remote site's connections can only traverse a restricted IP network and cannot transit any public or unrestricted IP network. A Restricted IP network is defined to be a network that enforces policies at all ingress and egress access points which specify a list of approved networks or hosts. General public use of a restricted IP network is not allowed. Restricted also ensures that the traffic from one point on the restricted IP network to another point on the same restricted network will not traverse any public or unrestricted IP network. In the event a public or unrestricted network must be traversed, encryption services must be supported.

##### **2.2.2.4.2 Encrypted Service**

A remote site may require encrypted network service to meet the security requirements . In these cases, it is required that NISN investigate , jointly with the NAS, applicable encryption technologies. Based on an economic business case, the most cost effective solution shall be employed. Encryption solutions may be hardware implementations, either embedded or stand-alone in the network processors, or software implementations in the respective end data processing systems. NISN shall make any necessary network modifications to accommodate encryption as needed.

### **2.3 Configuration Control**

#### **2.3.1 Documentation**

NISN shall maintain a configuration drawing representing the connectivity and resources utilized in providing services to the NAS. This drawing shall show NASA equipment, leased service/circuit identification and parameters, and the interface arrangement at each remote site. These drawings shall kept up to date on a monthly basis and should reflect all changes, both implemented and in-process, and should show only the NAS community. A baseline set of drawings is included in Appendix B, revisions to the format may be made through mutual agreement.

Copies of these configuration drawings shall be delivered within three business days of a request by NAS. It is the goal of NISN to provide these drawings upon demand via remote access technologies such as via WWW or FTP within 12 months.

#### 2.3.2 Advice and Consult

The NAS and the NISN jointly agree, as a matter of principle, to consult with each other regarding any future planning, technology changes, performance expectations, security issues, etc. that may materially change the performance of network connectivity to the NAS customer base.

Generally, the NAS shall be kept informed of the specific engineering and implementation configuration of NISN in meeting new NAS requirements but NISN shall not be required to seek NAS approval for the engineered configuration as a standard course of action.

### ***2.4 Network Operations***

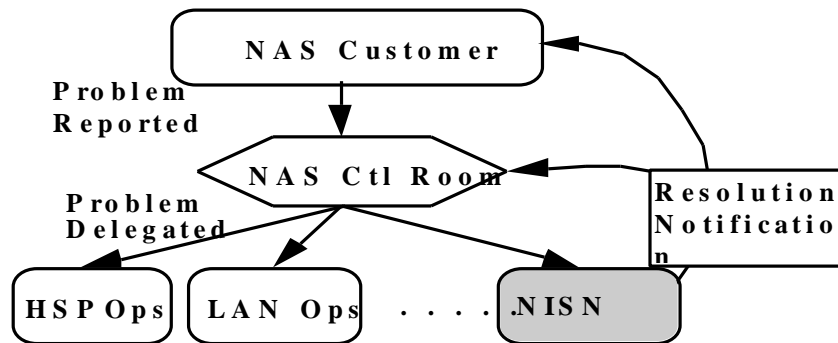
#### 2.4.1 Problem Resolution

NAS customers shall continue to report problems to the NAS Systems Control Room. This process insures efficiency as the majority of user problems are not related to the network services.

The NAS Control Room will perform initial analysis to determine if the problem is network related or related to the NAS high-speed processors and related software and equipment. If network related, the NAS Control Room shall contact the NISN Network Operations Center (NOC) and transfer ownership of the trouble ticket to the NOC. At this point, the NOC “owns” the trouble ticket and is “responsible” for the resolution and communications with the user who reported the problem. Upon resolution of the problem, the NOC is responsible for notifying both the NAS control room and the user that reported the problem. Figure 1 depicts the problem resolution process



**FIGURE 1. NAS Customer Problem Resolution Process**



#### 2.4.2 Planned Network Activity Reporting

The NISN Network Operations Center will inform and coordinate with the NAS Control Room of any scheduled network activities that would impact the continuity or quality of network services that are delivered to the NAS customers.

### 2.5 Metrics

NISN shall provide the following metrics to the NAS on a monthly reporting basis. It is the goal of NISN to provide these metrics upon demand via remote access technologies such as via WWW or FTP within 12 months.

The metrics to be recorded are:

1. Bytes in and out of every interface related to NAS customers.
2. Errors in and out of every interface related to NAS customers.
3. Link utilization for every NAS customer site averaged over an interval of fifteen (15) minutes or less.
4. Round trip latency to all NAS customer sites averaged over a 30 second interval. This report will be generated at the request of NAS and not generated monthly.
5. Availability on a per site basis as shown in table 3

**TABLE 3. Availability Report Format**

Site	% Availability	Packet Loss	
		Number of hours between	Number of hours between
		25-100%	2-24%


### **3. Administrative**

#### ***3.1 Technical Coordination***

NISN and the NAS shall each appoint a technical point of contact (TPOC) The respective TPOCs shall act as the primary contact for coordination of the delivery of services by the NISN to the NAS and shall coordinate service levels between the NAS and NISN for the respective project managers.

##### **3.1.1 TPOC Responsibilities**

3.1.1.1 ensuring that the network service levels are delivered according to this SLA.

3.1.1.2 ensuring that the NAS user communities networking requirements are being met and for working closely together in tuning the network performance to continue to service the NAS users effectively.

3.1.1.3 attending all meetings held by NISN/NAS that relate to the services required by the NAS user communities.

3.1.1.4 validating requirements and arriving at a technical solution that meets the required service level dictated by the Service Request (SR).

3.1.1.5 NAS TPOC - ensuring that the NISN TPOC/PM receives all NAS future requirements for the upcoming fiscal year at the time of the requirements call by NISN.

#### ***3.2 Programmatic Coordination***

NISN and the NAS shall each appoint a program manager (PM). The respective PMs shall act as the primary contact for coordinating funding levels between the NAS and NISN.

### 3.2.1 PM Responsibilities

3.2.1.1 NAS PM - ensuring that all NAS existing and planned requirements have sufficient funding available to cover their installation and continued service throughout the upcoming fiscal year.

3.2.1.2 NISN PM - ensuring that the NAS PM receives billing information as required and that the information is accurate.

### 3.3 *Funding*

#### 3.3.1 Process

As the Agency moves towards full cost accounting, the cost of operating a telecommunications infrastructure will necessarily be attributed to the costs and funding levels of the respective enterprises within NASA. It is unclear at this time as to the processes and procedures that will evolve prior to FY99 for attributing or collecting the necessary funding to operate the NISN. Therefore, this section will attempt to only set forth some general ground rules for NISN and NAS in the equitable determination of appropriate funding levels.

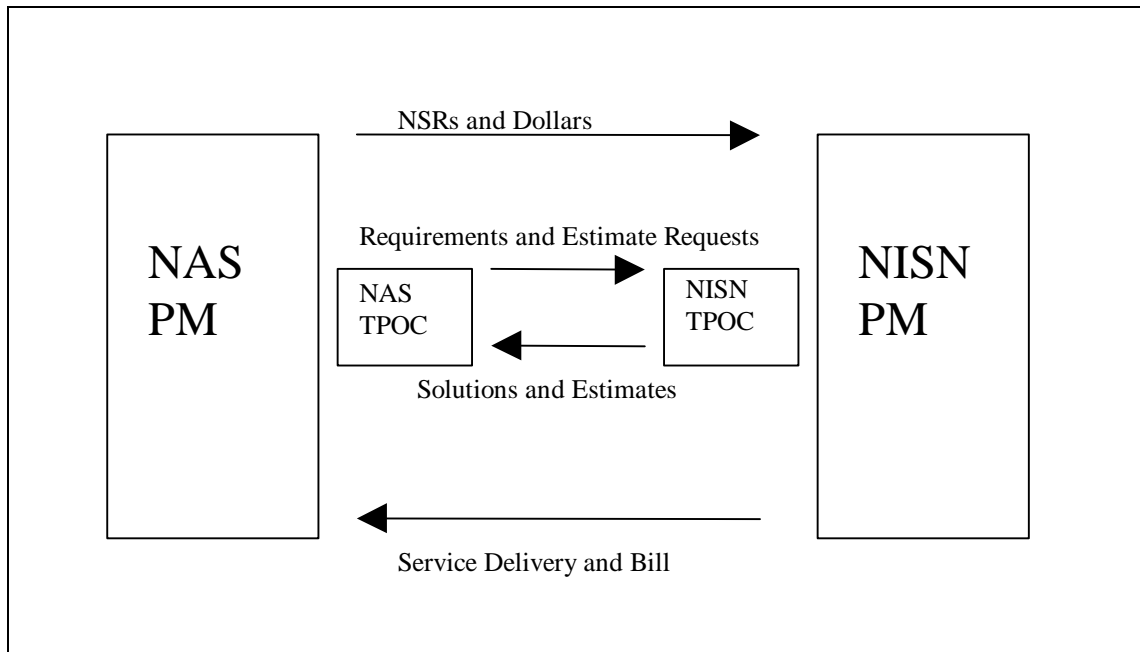
In January of each year. In preparation for the call for Program Operating Plans (POP), the NAS shall provide a projection of changes to the installed base of services provided by the NISN. NISN shall price the installed base of services along with the projected changes and shall provide the information to the NAS. This budgetary estimate shall be itemized containing the site name, site location, type of service, and yearly cost. The respective PMs must agree to the reasonableness of the respective estimates. It is agreed that the NISN engineering time that is required to generate the estimate will not be charged back to NAS. In the event that a requirement may dictate an unreasonable amount of engineering time, it is the responsibility of the NISN PM to notify the NAS PM that additional consulting hours will be needed to effectively complete the estimate. This notification should include an estimate of the number of hours required and the cost associated. The NAS PM will then approve or disapprove the proposal. If the proposal is refused, it is the responsibility of the NAS PM and NAS TPOC to reevaluate the requirement and resubmit the SR estimate.

Upon the decision by the NAS to add, change, or delete network services, the NAS shall submit to the NISN TPOC an appropriate service request form for implementation as specified in section 2.1.1. The NAS, either directly or through the appropriate Enterprise funding arrangements, shall provide funding to cover existing and future requirements

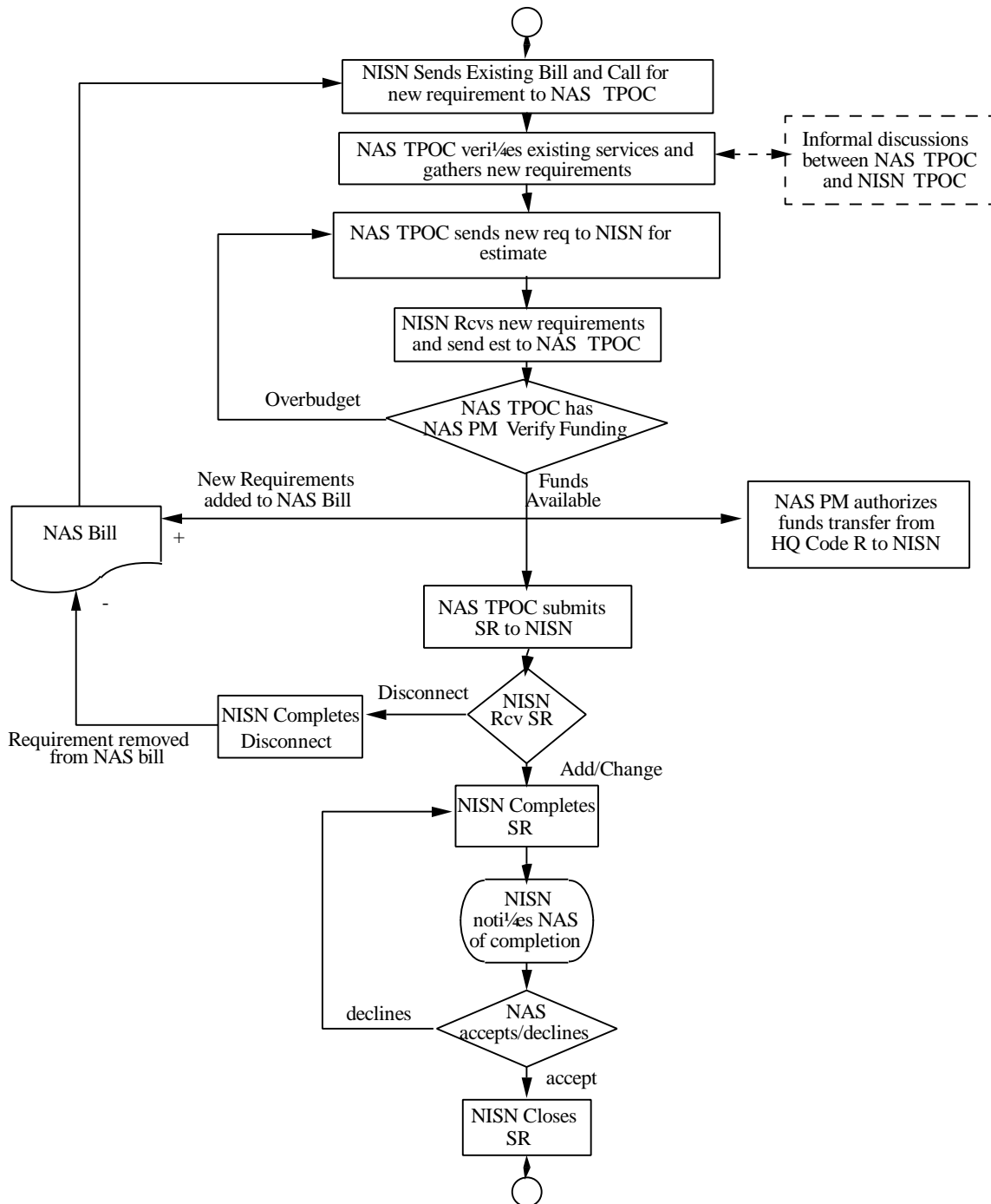
Upon request by the NAS PM, the NISN PM shall provide a spreadsheet outlining the current and projected NAS requirements, itemized by cost, in a timely manner.

Near term funding shall be required for bringing the transferred routers up to a current software revision level and upgrading the out-of band modem access at AEROnet remote sites to at least 9600bps. Costs associated with these upgrades shall be charged to the PSCN NASA Requirements & Cost Management System (NRCMS) account for NASA Code R, Office of Aeronautical Research, FY97.

### 3.4 Process Block Diagram



### 3.5 Process Flow Chart



### **3.6 Transition**

#### **3.6.1 Approach**

It is anticipated that transition of responsibilities for provisioning telecommunication services shall be transferred from the NAS to NISN in phases.

##### **3.6.1.1 Phase 1: Administrative Identification**

This phase consists of identification of the TPOCs and the PMs from both NAS and NISN.

##### **3.6.1.2 Phase 2: Operational Support Transition**

This transitional phase primarily consists of the transition of day-to-day operations, problem resolution, and maintenance of the existing assets that comprise the AEROnet as of February 1997. Under this transition, NISN agrees to:

- a. Assume property management and accountability of the AEROnet routers.
- b. Assume network management and monitoring responsibility of the AEROnet routers
- c. Assume hardware and software maintenance of the AEROnet routers.
- d. Assume responsibility for maintaining the IP domain address space and Domain Name Server (DNS)
- e. Perform any necessary software revision updates and out-of-band modem upgrades.

##### **3.6.1.3 Phase 3: Engineering Transition**

This phase primarily consists of the transition of engineering and provisioning of transmission services to the NAS customers. The responsibility for changes to the existing AEROnet backbone, transmission technologies employed, and future system upgrades necessary to meet the performance parameters specified in section 2.2.2.

#### **3.6.2 Property**

NISN agrees to assume property management and accountability of the AEROnet routers. The NAS program agrees to identify and assist in the transition of this property to NISN.

#### **3.6.3 Schedule**

The following schedule of transition activities is proposed, reference to the final approval of this document.

- |  |         |                 |
|--|---------|-----------------|
| a. Identify TPOCs and PMs                    | 1 day   | 4/21/97         |
| b. Network Monitoring:                       | 15 days | 4/21/97-5/6/97  |
| c. Problem Resolution (Network Layer):       | 15 days | 4/21/97-5/6/97  |
| d. Property Transfer:                        | 30 days | 4/21/97-5/21/97 |
| e. DNS and addressing:                       | 15 days | 5/1/97-5/15/97  |
| f. Revisions and upgrades to installed base: | 30 days | 5/15/97-6/15/97 |
| g. Full engineering Responsibilities:        | 60 days | 4/21/97-6/15/97 |
| h. Transition Complete                       |         | 6/15/97         |

## APPENDIX A

### NISN-NAS Service Intervals

SERVICE TYPE	DESCRIPTION	INTERVAL
New Location, Physical Circuit	Requires new/add local exchange loop	120 days
New Location, Virtual Circuit	Existing local access can accommodate change	30 days
Relocation of Physical Demark	Requires change to local exchange loop	120 days
Router Config Change (NISN)	Software config change of the AEROnet user router	3 days <sup>1</sup>
Router Config Change (NISN Expedite)	Expedited AEROnet user router config change	3 hours <sup>1</sup>
Change, Physical Circuit	Requires change to local exchange loop	120 days
Change, Virtual Circuit	Requires change to carrier provided virtual circuit, no change to access required	30 days

1. Within the normal business day, defined 8 to 7pm Central Time, Monday through Friday, excluding federal government legal holidays or weather emergencies.
2. The NAS TPOC shall be kept informed of any situation where the above time frames can not be met, the reason for the delay, and the new estimated time for completion of the service request.